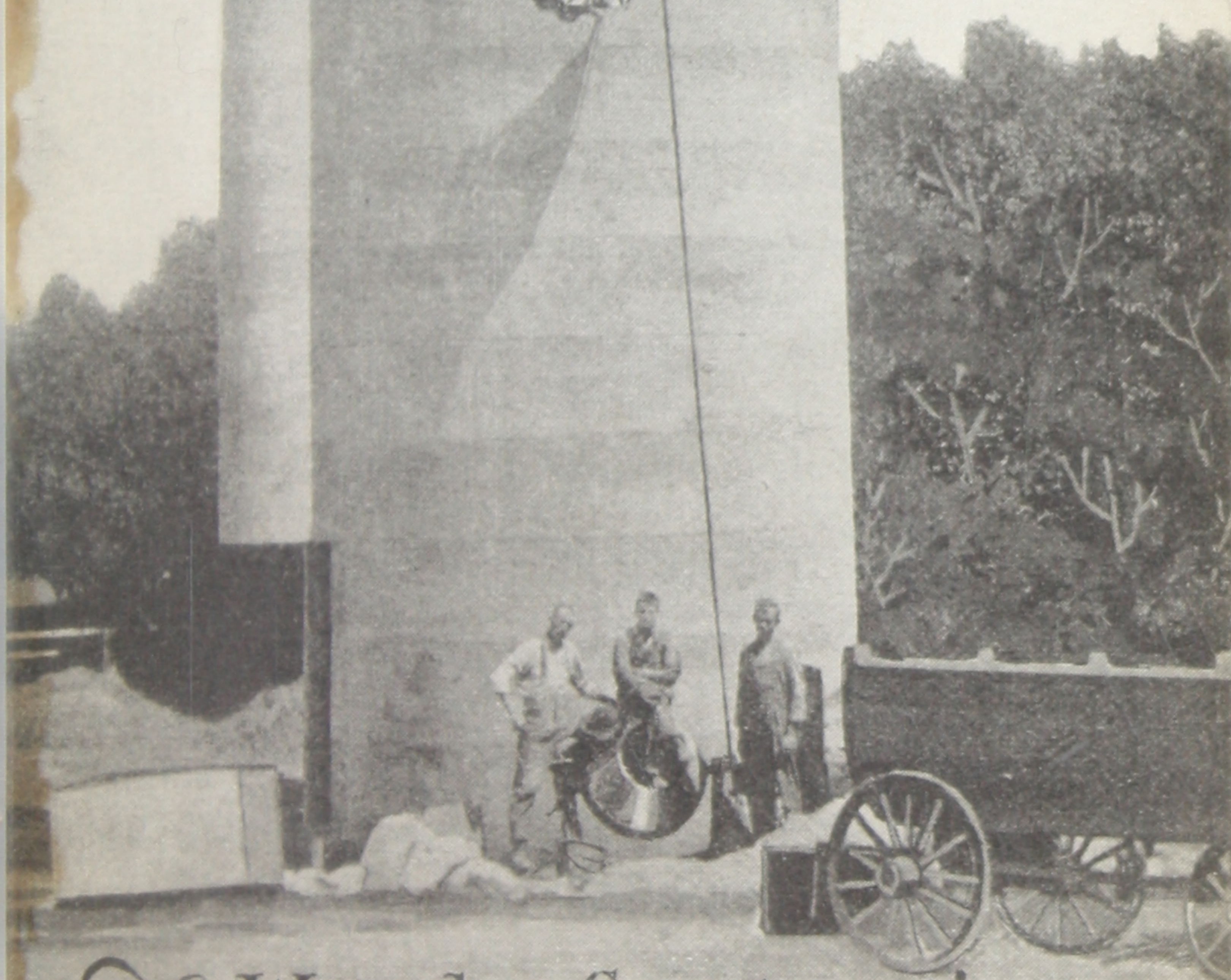


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# Hand Book on Mixing Concrete

JUL 24 '20

*Materials Proportioning,  
Methods of Mixing,  
Placing and Curing*



*The Waterloo Construction  
Machinery Company  
Waterloo, Iowa.*

## *The Personal Equation*

**W**HEN you buy a concrete mixer, or any other piece of construction machinery, you want to know that the machine is good—and that the manufacturers are good.

You want to know that there is behind your machine a stability that gives security to your investment.

You want to know, in case something happens to the machine, or it fails in some particular, that there is behind it responsibility and good intention that will set things right.

The Waterloo Construction Machinery Company is organized under the laws of Iowa, which are very rigid with respect to corporations, and its net assets are nearly \$300,000.00. Our organization includes branches in many of the principal cities of the United States and Canada, with approximately one hundred representatives, also an Export Department.

We have built Concrete Mixers and Contractors' Equipment for thirteen years. Our steadily expanding plant is supplied with the most modern time- and labor-saving machinery. This, with our large output, gives customers two important advantages—one is in price, the other is in quality that is reflected in small up-keep and long service.

One of the most gratifying things in our experience as manufacturers is the oft-repeated assertion by purchasers, that Waterloo Equipment does more than is expected of it—that it does more than we claim. Surely this is evidence of satisfaction.

*New York  
Boston  
Philadelphia  
Washington  
Winnipeg  
Atlanta  
El Paso  
Indianapolis  
Minneapolis  
Kansas City  
Denver  
Salt Lake City  
San Francisco  
Seattle  
Los Angeles*

### *The Waterloo Construction Machinery Company*

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Glenwood and Vinton Streets  
WATERLOO, IOWA, U. S. A.

# A Handbook On Mixing Concrete



## The Materials

CONCRETE is made of Portland cement, sand and gravel or crushed stone, in some definite proportions, and thoroughly mixed. It is

not difficult to make good concrete, but some rules must be observed if the product is to be satisfactory, and it is the purpose of this book to explain the fundamental principles of its mixing. Although all the materials may be good, and they are properly measured, certain failure will result if they are not thoroughly mixed. *The Proof of the Concrete is in the Mixing.*

## Portland Cement

Good Portland cement can be obtained anywhere if ordinary care is exercised, and it should be said that all the quantities given in this book are based upon the use of Portland cement of standard quality. There are many natural cements manufactured, but they have not been standardized as carefully as Portland cement and some adjustments in the proportioning would have to be made if one of these cements should be chosen. Portland cement is made of argillaceous materials (clay), and calcareous materials (lime), ground up together; sintered, that is, heated in kilns to the point of fusion, and then ground very fine with a small amount of gypsum added to retard setting. This definition is given to aid in checking up different cements so that adjustments can be made when proportioning.

## Sand and Gravel

Natural sand is found in almost every locality, but when the natural kind is not obtainable other kinds made by crushing rock can be used. It should be coarse rather than fine, and the large particles left after screening for fine plastering sand is far better than sand which runs uniformly small. Sand which runs in a variety of sizes from fine to coarse is better than sand which is all of one size, but if the particles are all of one size it is better to have them nearer  $\frac{1}{4}$ -inch in size than smaller. The particles should be hard and tough, but they do not need to be "sharp," as in the case of plastering sand.

Gravel is not as common as sand and very frequently crushed stone must be used instead. When gravel is to be had it is an excellent coarse aggregate (the sand is called the fine aggregate) and will make just as good concrete as crushed stone. The shape of the pieces makes little difference so long as they are not flat. It seems at first thought that the sharp corners of crushed stone would get a better grip on the mortar and make a stronger concrete, but this is not true if the gravel is clean and well mixed with the other materials.

## Crushed Stone

When gravel cannot be found, crushed stone is almost certain to be handy and it will make just as good con-



crete as gravel. In fact for ordinary work there is no difference. Both must be hard and tough. The pieces of crushed stone will be of all shapes and some kinds will require a little longer mixing than gravel. For most jobs the pieces should not be larger than  $1\frac{1}{4}$  inch, but for some work the coarse aggregate should be smaller as for surface finishing and floors. Sometimes the work is done in two courses and then a coarse aggregate made up of large pieces will be used in the base, and a material with pieces not over  $\frac{3}{4}$ -inch in size will be used for the top.

## Cleanliness

Great care should be taken to use only clean materials. When concrete is mixed the particles of sand are coated with wet cement, and then the pieces of gravel or stone are coated with this sand and cement. Sand and gravel that grade into various sizes so that the spaces between all the large pieces are filled with smaller pieces, so that the smallest amount of cement can be used to coat all the particles and bind them together. The strength of the concrete depends upon the binding of the particles together. If the particles have a coating of clay over them the cement cannot take hold and the concrete will be weak. Pieces of wood or vegetable matter cannot be admitted, and sand or gravel which has foreign matter of this kind in it should not be used. The water should be only such as is fit to drink.

## Proportioning

Certain proportions have been found to be especially suited to certain kinds of work. Good results will never be obtained guessing at the amount of materials to use. Nor will the work be satisfactory if the materials are not chosen carefully, and measured accurately. Where sand and gravel occur together they must be separated by screening and then used separately. It is impossible to tell by looking at these materials as they come out of the pit what proportions of sand and gravel they contain, and to use them that way is only borrowing trouble. *It will be cheaper in the long run to observe the rules and measure all materials accurately.*

The cement can be measured out by sacks or parts of a sack, for a sack usually contains a cubic foot, or 94 pounds, of cement. The sand and gravel should be measured in boxes having no bottoms. The measuring box is set down on the mixing platform and filled to the right depth with material, and then the box is lifted off, leaving the material in a pile on the platform. The box is very easy to make and will save a great deal of work, as well as guessing. If concrete of the proportions 1:2:4 is used, meaning 1 sack of cement, 2 cubic feet of sand, and 4 cubic feet of gravel, the box would be made to hold 4 cubic feet of material and a strip of thin wood nailed around the inside at half the height for the sand measurement. If only one



sack of cement is to be used at a time, a box 18 inches square and 21 inches high would be made for measuring.

## The Unit System



The unit system of proportioning is the best, using the sack of cement as the unit. One advantage in using this system is that the quantity of cement in a sack is the only quantity needed for proportioning. All other materials are used in multiples of that quantity. The following table is given in cubic feet, but it could just as well be taken to mean pounds or anything else as long as the sack of cement is used as the base. (*Building Age*, January, 1919.)

Proportions of Materials in common use.			Volume of Concrete Produced	Quantities of Materials required for one Unit Volume of Concrete		
Cement	Sand	Gravel		Cement	Sand	Gravel
1	1.5	0	1.75	.57	.86	
1	2	0	2.1	.48	.96	
1	3	0	2.8	.36	1.08	
1	1.5	3	3.5	.29	.43	.87
1	2	3	3.9	.25	.50	.75
1	2	4	4.5	.22	.44	.88
1	2.5	5	5.4	.19	.47	.90
1	3	5	5.8	.17	.51	.85
1	3	6	6.2	.16	.48	.96

The first three proportions in this table are for plaster, stucco or surface work, in which no coarse aggregate is used. The volume of mixed concrete made by any materials will be two-thirds of the volume of the loose materials; or, the volume of loose material is  $1\frac{1}{2}$  times the volume of mixed concrete. If the factors in the last three columns of the table for any proportions are added together the sum will be close to 1.50 or  $1\frac{1}{2}$  times the unit volume 1. So it makes no difference whether the unit volume is taken in pounds, cubic feet or some metrical quantity, the table will work just as well. It is the only universal method and it is just as good for large quantities as for small ones.

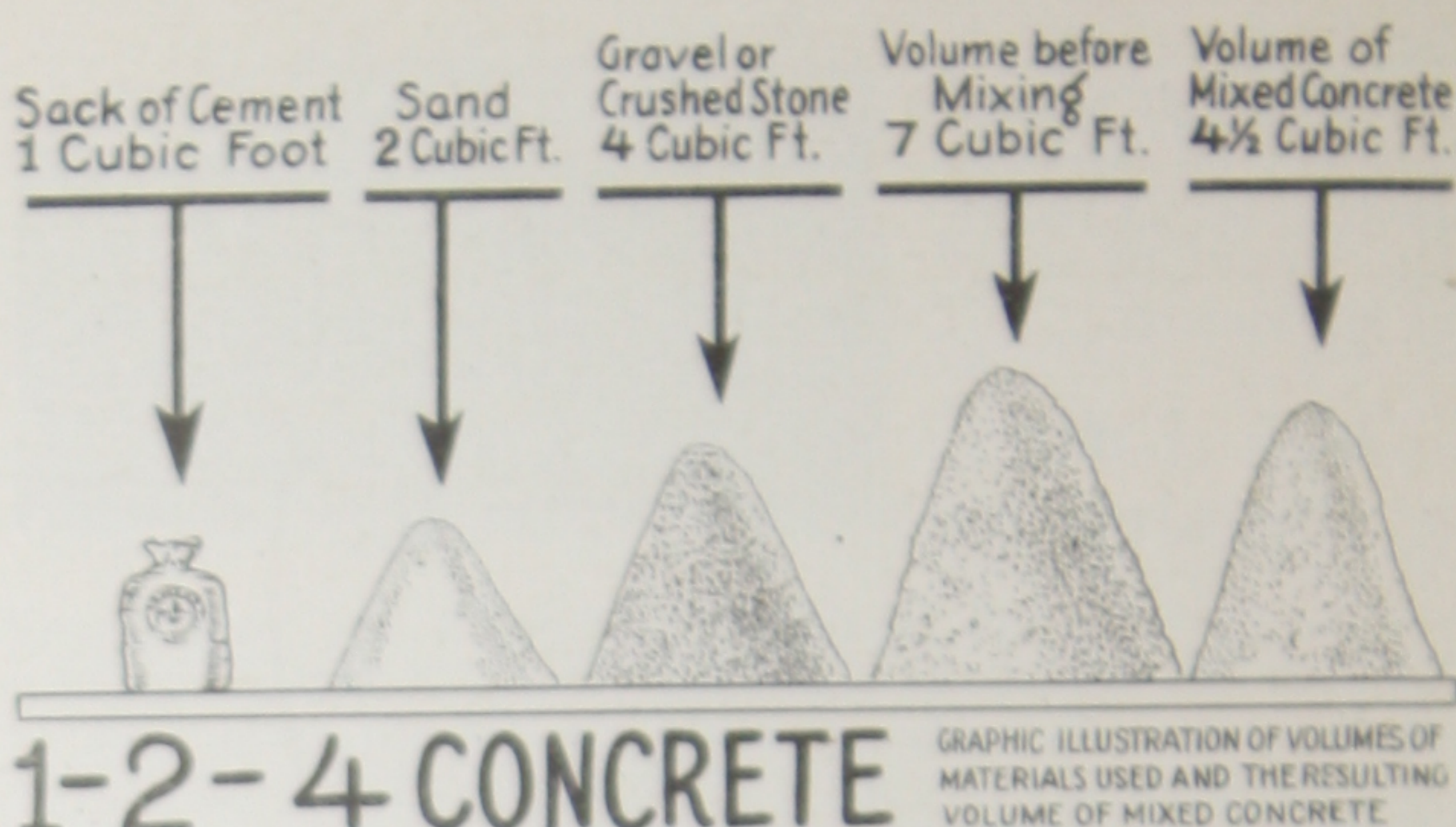
## How to Estimate

Now to estimate the quantity of concrete needed for some particular job the volume of concrete in the completed structure must first be found. Usually this can be ascertained by multiplying length, width and thickness together, and making additions or subtractions for openings and variations. For example, consider a walk 82 feet long, 3 feet wide and 5 inches thick. There are 246 square feet of surface, and this multiplied by the thickness in feet gives the number of cubic feet of concrete in the job.

$$\frac{82 \times 3 \times 5}{12} = 102.5 \text{ cu. ft.}$$



Suppose the concrete to be of the proportions 1:2:4; as stated in first three columns of the table. In the fourth column is the amount of



concrete made with these quantities, 4.5. Then in the next column the cement is given as .22; in the next column the sand is given as .44; and in the last column the gravel or stone is given as .88. The amount of concrete in the job is multiplied by these factors to give the quantities of the three materials needed. If it should be calculated with cubic feet 102.5 would be multiplied by the factors and we would find that we needed 25 sacks of cement, or 25 cubic feet, 50 cubic feet of sand, and 100 cubic feet of gravel or stone. All these quantities should be increased by ten per cent to allow for the waste that cannot be prevented in handling.

The practice in the United States is to count 4 sacks of cement to a barrel, 27 cubic feet of sand or gravel to a cubic yard, and 19 to 22 cubic feet of sand or gravel to a ton of 2000 pounds. A sack of cement of one cubic foot weighs 94 pounds and a barrel 376 pounds; a cubic yard of sand or gravel will vary from 2400 to 2900 lbs.

**For Roads.** 1:1½:3. This is a rich mixture for concrete roads and other surfaces on which there is a great deal of wear. For thin slabs. For building columns supporting great weights. For any other work required to be especially strong. For concrete which must be water-tight.

**For Fence Posts.** 1:2:3. For practically the same uses as 1:1½:3. When sand in the proportion 1:1½:3 does not seem to fill the spaces between the pieces of stone, another ½ part of sand can be added. A good mixture for fence posts when ½-in. to ¾-in. stone is used.

**For Silos, Sidewalks and Many Other Uses.** 1:2:4. A standard mixture for sidewalks, culverts, tanks, sewers, concrete blocks and tile, conduits, cisterns, well curbs, silos, feeding floors for live stock, cellar floors, barn floors, curb and gutter work. For foundations for machinery that causes vibrations, such as engines. For reinforced floors, beams and columns in buildings. For ordinary water-tight work.

**For Walls and Floors.** 1:2½:5. A medium mixture for retaining walls, building walls, thin foundation walls, abutments, piers, and ordinary machinery foundations. For cellar floors which are not to receive hard usage or to be water-tight. For the base course in two-course side-



walks or pavements. For sewers with thick walls.

1:3:5. A mixture between 1:2½:5 and 1:3:6 in all uses.

**For Heavy Walls.** 1:3:6. A lean mixture for use in masses. For heavy walls.

## Disadvantages of Mixing By Hand

WHEN the first machine for mixing concrete was offered for sale it made slow progress, as in the case of every other labor-saving machine that has been accepted generally. Before that all concrete was mixed by hand on mixing platforms. This way of doing it has become very rare now, for concrete has come into such universal use in building, in concrete roads, dams and all outdoor work that inferior concrete cannot be accepted. Only machine-mixed concrete is dependable. The cost of hand-mixed is very high, and extraordinary care must be used. Laborers cannot be permitted to do the mixing without constant supervision by an experienced foreman. The quality of this hand-mixed concrete will vary with the personal condition and industry of the men. In the morning they may do very well but later in the day when they become tired the output will be less and its quality poorer.

Usually it is difficult to get men who will turn concrete by hand after they have seen it done by a machine, for it is very laborious. This will be plainly seen in the following photographs. The



*Lifting the Measuring Box  
off the Sand.*

small photographs preceding this show the ease with which a machine is handled, and a comparison of costs will show that the machine will not only produce better concrete but do that all day long with a great saving in cost.

The sand must be shoveled into a measuring box on the mixing platform, as shown in the first

picture, and then the box is lifted off, leaving the sand in a pile.

Then the sacks of cement, weighing ninety-four pounds apiece, must be lifted bodily and emptied over the sand, as shown in the next illustration.

The men then turn the sand and cement together with shovels, hoes and rakes, until they are mixed thoroughly, with no streaks of cement showing in the sand.



*Sifting Cement over the Sand.*

After this the gravel or stone is spread on top of the sand and cement. The stone has to be handled in wheelbarrows from piles of material, and shoveled twice. Or else the men are allowed to push the wheelbarrows right up on the mixing platform, carrying dirt into the mixture.

When all the materials have been turned to-



*Turning the Cement and Sand Together.*

gether several times, enough water is added to make a rather stiff, quaky mass. Then the mass, now made heavier by the water, must be turned again and again, from one pile into another until it is certain that every piece of stone or gravel is

coated with the mixture of sand and cement. Four or five times is not too often to turn it, for here is where the quality of the concrete is determined. *The Proof of the Concrete is in the Mixing.*

The next illustration shows the concrete mixed and ready to be hauled away for use.

## Placing and Curing

After the concrete has been put in place and rammed down into a dense mass in the forms it



*Cement, Sand and Gravel Together.  
Adding the Water.*

should be covered with dirt, canvas, or some other material that can be kept moist, and this covering should be sprinkled with water once a day for ten days to cure the concrete.

## Output

It is known that a crew of six men mixing by



*Turning all the Materials  
Together.*

hand can make about 15 cubic yards of concrete in ten hours, but it is very often less than that. In fact 15 cubic yards is very generous. Add to this the certainty that the concrete will not be uniformly good, with some of it unfit for use, and

it will be seen why all concrete for use in construction is being mixed in machines.

Every batch of concrete that goes into a structure is important for if a batch of poor concrete should be placed where weight is to be placed on it the structure will fail. That batch might be made at the end of the day's work when the men are tired, but so much depends upon the integrity



*Mixed Concrete Being  
Hauled Away.*

of that batch that complete failure may result from mixing carelessly by hand. A machine works just the same throughout the day and the last batch will be just as good as the first. The cost of the machine will be saved again and again in lower costs on the job, and in addition it will be a guarantee of the quality of the concrete all through the work.

## The Best Is Always the Cheapest

THERE are many concrete mixers on the market, of many degrees of efficiency, and it pays to buy only the best machine in the beginning. Heretofore that has meant a much higher price but now there are mixers of excellent quality to be had at very reasonable figures.

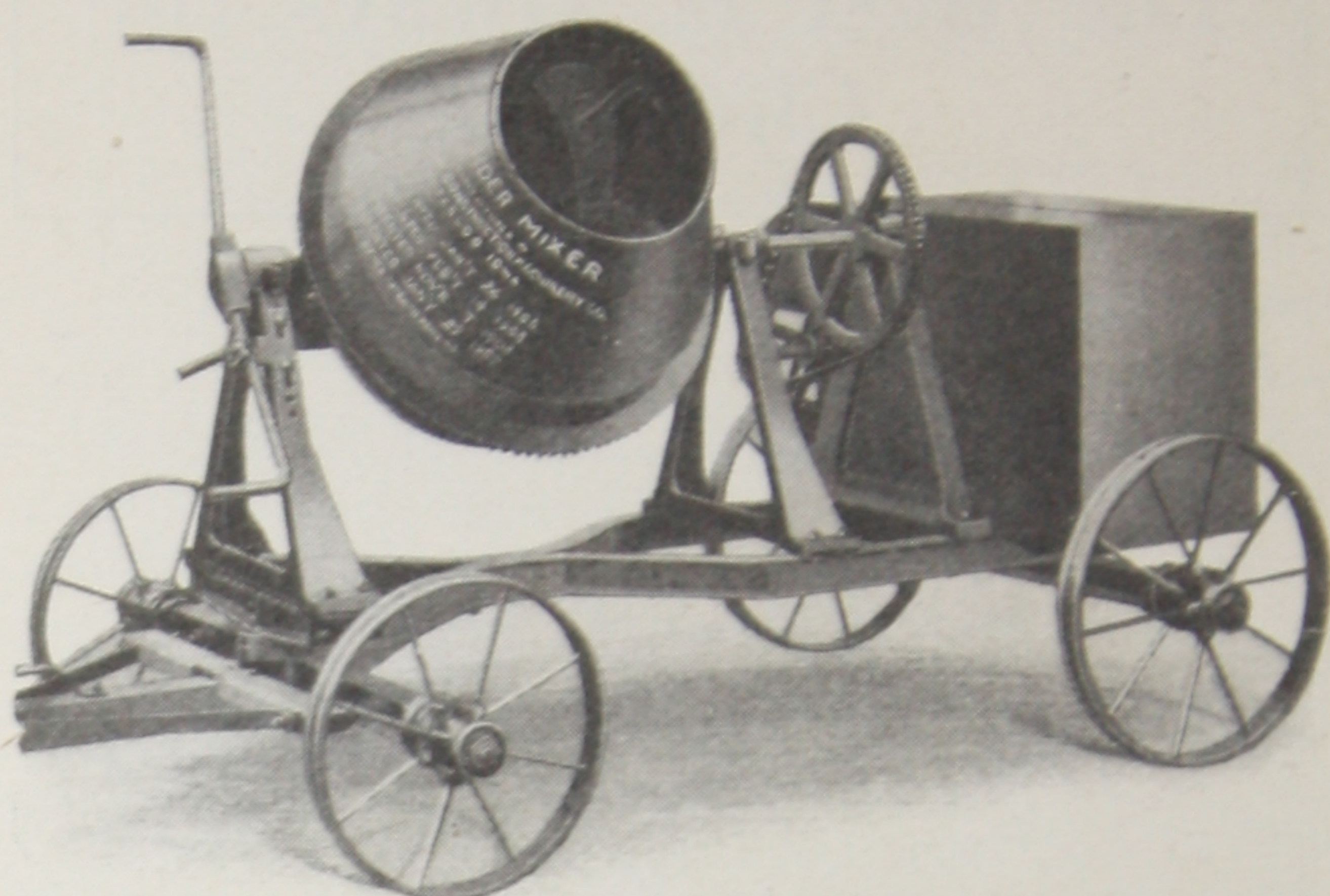
*The Waterloo Construction Machinery Company*, called the Waterloo Cement Machinery Corporation until the spring of 1919, has been making concrete mixers for thirteen (13) years, and the WONDER Concrete Mixer is known wherever construction work is carried on as the fastest mixer made. It is offered at reasonable prices, and it demonstrates in everyday work that no one engaged in building or contracting can afford to be without it. The material used throughout is the best that can be obtained; the workmanship is of high quality; and the machines are built on a quality basis from beginning to end.

The capacities of the different sizes are given with the descriptions in the pages following. The capacity in each case being the same as the size of the batch turned out, rated in cubic feet. Thus, the WONDER 3 makes a batch of 3 cubic feet; the WONDERS 4, 5 and 7 make batches of 4, 5 and 7 cubic feet. The WONDER 7 Paver makes a batch of 7 cubic feet. A Side Loader added to any of the three larger sizes is an excellent investment, for it eliminates shoveling entirely and does away with that many more men, also with the extra supervision needed for the larger force. A loader will pay for itself on any good-sized job and the whole crew will work faster and more steadily. There will be less unrest and less danger of controversies. While the WONDER Mixer without a loader is faster than any other machine, it will be still faster with the loader—enough faster to make it a fine investment for anyone.

### Service

We welcome opportunities to be of service to all our customers and prospective customers. Our business has been built up on the principle of giving all we can for a reasonable price, with real service to our purchasers, and with every effort made to understand their interests and appreciate their point of view. We maintain a very complete Service Department which handles all repairs, research, complaints and helps for the owners of machines. We have a complete record of the numbers of our machines, the engines, and the owners, so that prompt service is assured. We do not want to sell any machine to you except just the one you ought to have. We would like to consult with you about your work and recommend the proper equipment for your jobs. Our best asset is in the long list of satisfied customers who we claim as friends.





## Wonder 4 without Side Loader

Capacity per batch { 4 cubic feet of mixed concrete.  
5 to 6 cubic feet of loose material.

*Drum*—Exclusive WONDER shape. Close-grained metal cast bowl; reinforced steel cone, 19" opening, 4 non breakable mixing blades, two 5"x12" and two 6"x18", set 2" away from drum to aid mixing and cleaning.

*Drum Bearing*—1½" cold rolled polished steel, internal bearing; ¾" steel ball thrust bearing fully protected; outside dust-proof oiler readily accessible. No rollers to replace.

*Yoke*—Semi-steel, accurately machined; I-beam section to insure strength and rigidity.

*Discharge*—Tilting Drum, operated by conveniently placed hand levers; adjustable stop at mixing position. Gear Tilt can be furnished at small additional cost.

*Frame*—3"x7½"-lb. I-beam hot pressed to shape and hot riveted with ½" rivets.

*Trucks*—Axles, steel. Wheels, steel, 22" front, 26" rear. Tires have depressed centers to protect spoke-heads. Spokes, staggered.

*Transmission*—Pressed steel chain. Pinion shaft supported by two bearings. Sprocket wheels semi-steel.

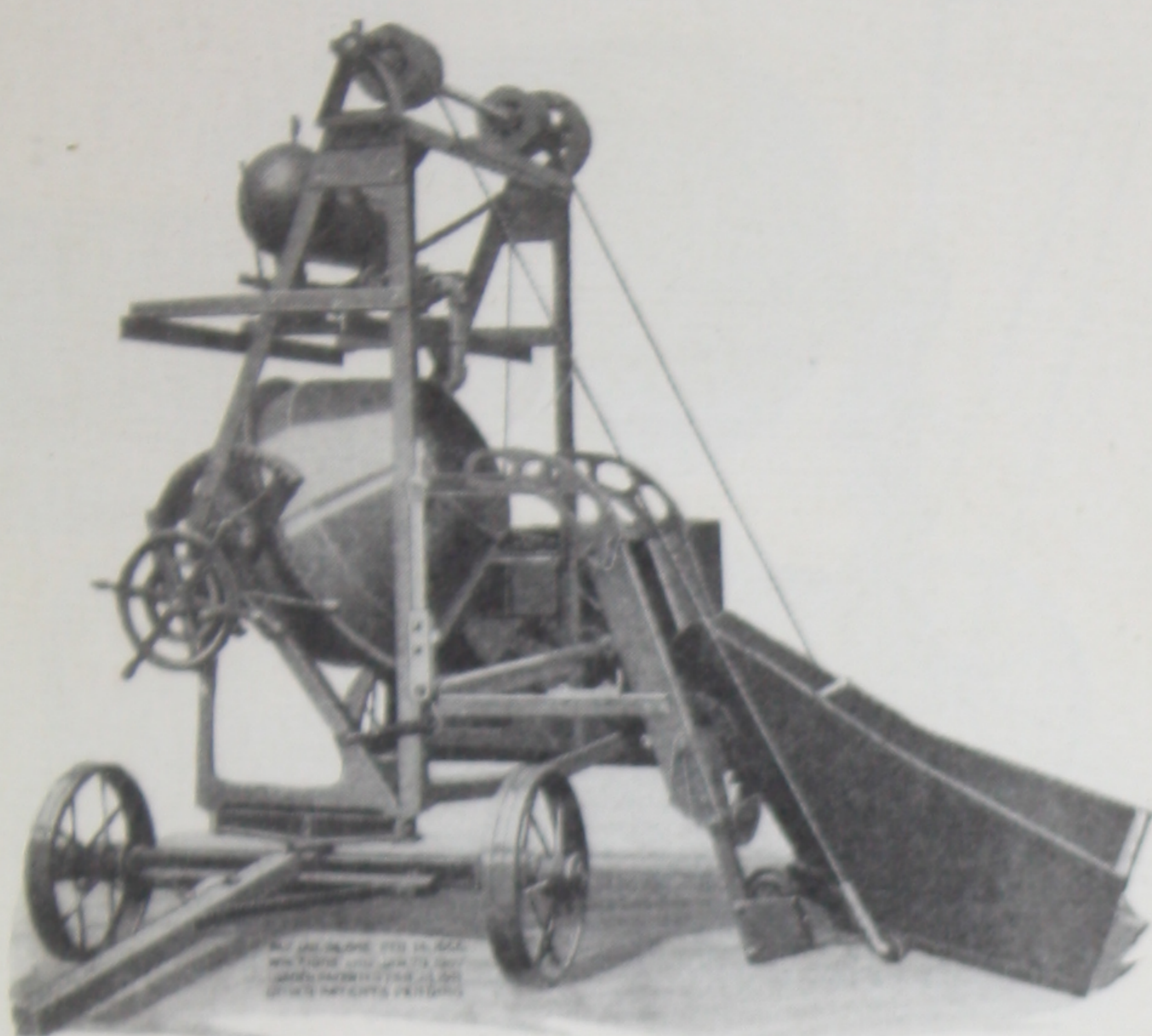
*Engine*—3 H. P., four-cycle, horizontal, hopper-cooled, WONDER type, magneto ignition. Bore, 4¼"; stroke, 6"; speed, 450 r. p. m. Crank shaft drop forged steel, 1½" diameter, ground to size.

*Equipment*—Furnished with or without loader, water-measuring tank, rotary pump, light hoist, or with gasoline, steam or electric power.



### Weights—Wonder 4 without Loader

Mixer on trucks with gasoline engine and steel house.....	1700 lbs.
On trucks without power.....	1150 lbs.
On steel skids with gasoline engine housed .....	1370 lbs.
On steel skids without power....	820 lbs.



## Wonder 4 with Folding Track Loader

*Frame*— $2\frac{1}{2}$ "x $2\frac{1}{2}$ "x $\frac{1}{4}$ " steel angles joined by  $\frac{3}{8}$ " gusset plates, batter-braced and rigidly secured to mixer. Track, 5" steel throughout.

*Skip*—Width at back, 36"; height at back, 13"; angle in discharging, 50°; built of  $\frac{3}{8}$ " steel plates reinforced with  $1\frac{1}{2}$ "x $1\frac{1}{2}$ "x $\frac{1}{4}$ " angle steel frame. Skip is raised with  $\frac{3}{8}$ " crucible steel cable. Spring buffer provided on frame.

*Loader Hoist*—Drum, 8" diameter. Overhead drum, 10" diameter. Cable spools, 6" diameter. Overhead shaft,  $1\frac{1}{2}$ " cold rolled polished steel, supported by two babbitted bearings, 3" wide, adjustable to wear. Clutch, cone hoist type,  $11\frac{3}{4}$ " diameter,  $1\frac{1}{2}$ " face. Brake, band type, with non-burning asbestos lining. Control, one-man, one-lever—impossible to use clutch against brake.

*Water-Measuring Tank*—Electrically welded, 14"x20", 12 gallon capacity, tested to 200 lbs. air pressure. Easily adjustable, no internal mechanism. Water feed pipe,  $1\frac{1}{2}$ " diameter.

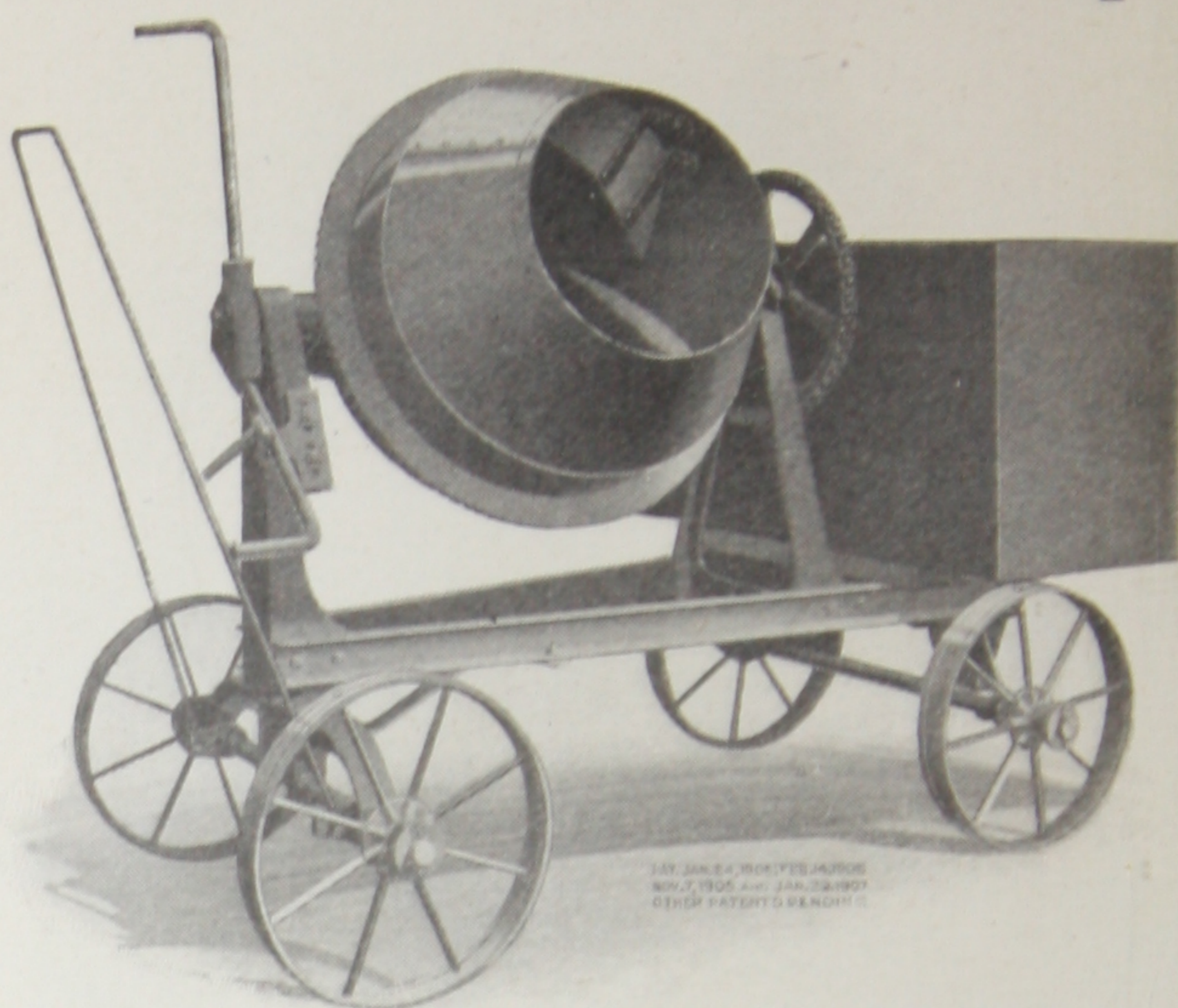
*General*—All machines tested under own power and loaders must lift 75% overload. Gear Tilt can be furnished at small additional cost.

### Weights—Wonder 4 with Loader

On trucks with loader, engine,  
steel house and water-meas-  
uring tank .....2750 lbs

On trucks without water-measur-  
ing tank .....2625 lbs.





## Wonder 3

THE WONDER 3 has the "long life" integrity of construction that characterizes all WONDER equipment. It can be used in cramped quarters, handled on elevators and taken into buildings. It supplies the demand for a mixer of suitable size and price for the small contractor or builder, and is also profitable in detail work on large jobs.

**Capacity per batch** { 3 cubic feet of mixed concrete.  
4 cubic feet of loose material.

*Drum*—Exclusive WONDER shape. Close-grained metal cast bowl; reinforced steel cone, 19" opening, four non-breakable mixing blades—two 5"x12" and two 6"x8", set 2" away from drum to aid mixing and cleaning.

*Drum Bearing*—1½" cold rolled polished steel, internal bearing; ¾" steel ball thrust bearing fully protected; outside dust-proof oiler readily accessible. No rollers to replace.

*Yoke*—Semi-steel accurately machined. I-beam section to insure strength and rigidity.

*Discharge*—Tilting drum operated by conveniently placed hand levers; adjustable stop at mixing position.

*Frame*—3"x4-lb. steel channels.

*Trucks*—Axles, 1½" round steel. Wheels, 20" diameter front and rear; tires 3" wide; ¾" thick; depressed centers to protect spoke-heads—spokes staggered. Front and rear wheels same tread (36"). Hauling bail as shown, furnished with each machine.

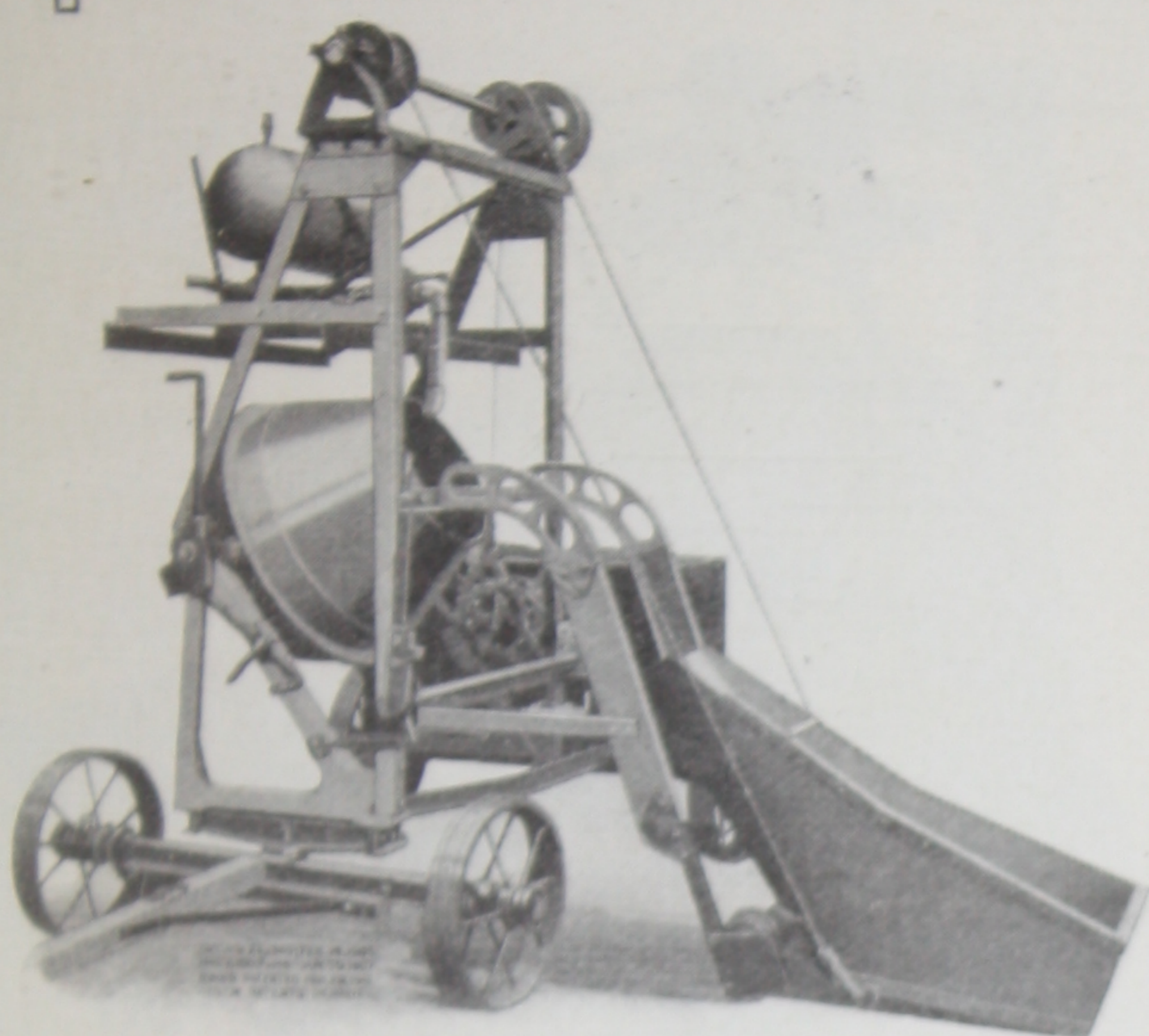
*Transmission*—Pressed steel chain. Sprocket wheels semi-steel.

*Engine*—2 H. P., four-cycle, horizontal, hopper-cooled, WONDER type, magneto ignition. Bore, 3½"; stroke, 5"; speed, 500 r. p. m. Crank shaft drop forged steel, 1¼" diameter, ground to size.

*Equipment*—Furnished with or without trucks or engine.

### Weights—Wonder 3

Mixer on trucks with gasoline engine and steel house.....	1175 lbs.
On trucks without power.....	850 lbs.
On steel skids with gasoline engine housed.....	900 lbs.
On steel skids without power.....	575 lbs.



## Wonder 5 with Folding Track Loader

Capacity per batch { 5 cubic feet of mixed concrete.  
7 to 8 cubic feet of loose material.

*Drum*—Exclusive WONDER shape. Close-grained metal cast bowl; reinforced steel cone, 22" opening. Four non-breakable mixing blades—two of these 5"x12" and two 6"x18" set 2" away from drum to aid mixing and cleaning.

*Drum Bearing*—1 $\frac{1}{4}$ " cold rolled polished steel, internal bearing;  $\frac{3}{4}$ " steel ball thrust bearing fully protected; outside dust-proof oiler readily accessible. No rollers to replace.

*Yoke*—Semi-steel, accurately machined; I-beam section to insure strength and rigidity.

*Discharge*—Tilting drum operated by back geared hand wheel; stop at mixing position.

*Frame*—3"x7 $\frac{1}{2}$ "-lb. I-beam hot pressed to shape and hot riveted with  $\frac{1}{2}$ " rivets.

*Trucks*—Axles, steel. Standard wagon gauge (56"). Wheels, steel, 23" front, 26" rear. Tires have depressed center to protect spoke-heads. Spokes, staggered.

*Transmission*—Pressed steel chain. Pinion shaft supported by two bearings. Sprocket wheels semi-steel.

*Engine*—5 H. P., four-cycle, horizontal, hopper-cooled, WONDER type, magneto ignition. Bore, 4 $\frac{1}{2}$ "; stroke, 9"; speed 375 r. p. m. Crank shaft drop forged steel, 1 $\frac{1}{8}$ " diameter, ground to size. Furnished with 3 $\frac{1}{2}$  H. P. engine on WONDER 5 without loader.

*Equipment*—Furnished with or without loader, water-measuring tank, rotary pump, light hoist, or with gasoline, steam or electric power.

### Specifications—Folding Track Loader

*Frame*—2 $\frac{1}{2}$ "x2 $\frac{1}{2}$ "x $\frac{1}{4}$ " steel angles joined by  $\frac{3}{8}$ " gusset plates, batter-braced and rigidly secured to mixer. Track, 5" steel throughout.

*Skip*—Width at back, 40"; height at back, 13"; angle in discharging, 50°; built of  $\frac{1}{8}$ " steel plates reinforced with 1 $\frac{1}{2}$ "x1 $\frac{1}{2}$ "x $\frac{1}{8}$ " angle steel frame. Skip is raised with  $\frac{3}{8}$ " crucible steel cable. Spring buffer provided on frame.

*Loader Hoist*—Drum, 8" diameter; overhead drum, 10" diameter. Cable spools, 6" diameter. Overhead shaft, 1 $\frac{1}{2}$ " cold rolled polished steel, supported by two babbitted bearings 3" wide, adjustable for wear.

*Clutch*—Cone, hoisting engine type, 11 $\frac{1}{4}$ " diameter, 1 $\frac{1}{2}$ " face.

*Brake*—Band type, with non-burning asbestos lining.

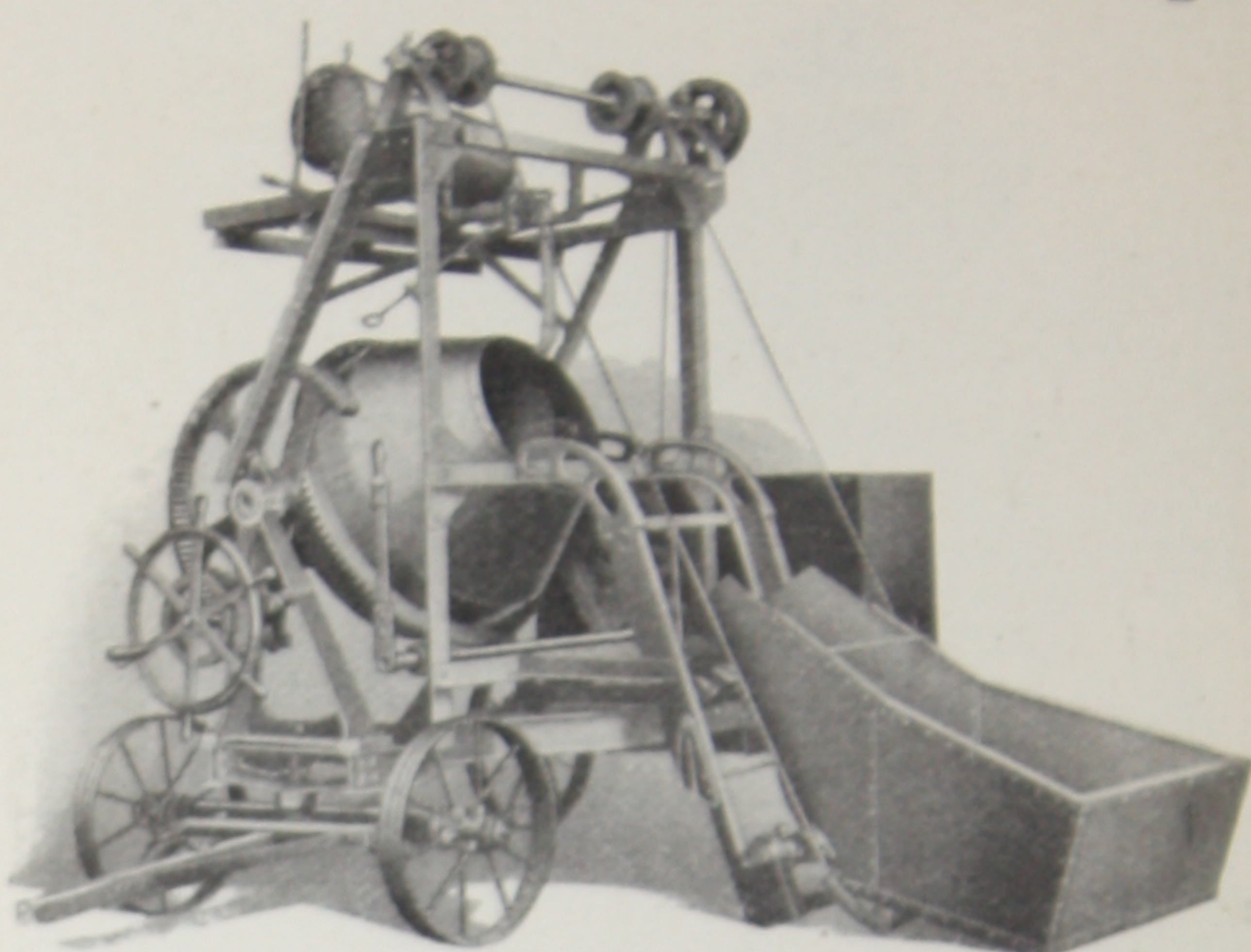
*Control*—One-man, one-lever—impossible to use clutch against brake.

*Water-Measuring Tank*—Electrically welded, 14"x20", 12 gallon capacity, tested to 200 lbs. air pressure. Easily adjustable, no internal mechanism. Water feed pipe, 1 $\frac{1}{2}$ " diameter.

*General*—All machines tested under own power and loaders must lift 75% overload.

### Weights—Wonder 5 with Loader

On trucks with engine housed, side loader and tank.....3375 lbs.  
Mixer on trucks with gasoline engine housed and side loader.3250 lbs.



## Wonder 7 with Folding Track Loader

Capacity per batch { 7 cubic feet of mixed concrete.  
10 to 11 cubic feet of loose material.

*Drum*—Exclusive WONDER shape. Close-grained metal cast bowl; reinforced steel cone, 23" opening. Four non-breakable mixing blades—two of these 9"x22" and two 8"x19", set 2" away from drum.

*Drum Bearing*—1 $\frac{1}{8}$ " cold rolled polished steel internal bearing;  $\frac{3}{4}$ " steel ball thrust bearing fully protected; outside dust-proof oiler readily accessible. No rollers to replace.

*Yoke*—Semi-steel, accurately machined, hollow oval section.

*Frame*—5"x9 $\frac{3}{4}$ "-lb. I-beam, hot pressed to shape and hot riveted with  $\frac{5}{8}$ " rivets.

*Transmission*—Pressed steel chain. Pinion shaft supported by two bearings. Sprocket wheels semi-steel. Internal expanding clutch, 12" diameter, 2" face.

*Trucks*—Axles, 4"x7 $\frac{1}{2}$ "-lb. steel I-beams. Skeins, 3 $\frac{1}{4}$ "x10. Standard wagon gauge (56"). Wheels, steel, 26" front, 30" rear. Tires, 4", depressed center to protect spoke-heads. Spokes, oval staggered.

*Discharge*—Tilting Drum, operated by back geared hand-wheel, with stop at mixing position.

*Engine*—5 H. P., four-cycle, horizontal, hopper cooled WONDER type, magneto ignition. Bore, 4 $\frac{1}{2}$ "; stroke, 9"; speed 375 r. p. m. Crank shaft drop forged steel, 1 $\frac{1}{8}$ " diameter, ground to size.

*Equipment*—Furnished with or without loader, water-measuring tank, rotary pump, light hoist, or with gasoline, steam or electric power.

### Specifications—Folding Track Loader

*Frame*—3"x3"x $\frac{5}{16}$ " steel angles joined by  $\frac{3}{16}$ " gusset plates, batter-braced and rigidly secured to mixer. Track, 5" steel throughout.

*Skip*—Width at back, 42"; height at back, 16"; angle in discharging, 50°; built of  $\frac{1}{8}$ " steel plates, reinforced with 1 $\frac{1}{2}$ "x1 $\frac{1}{2}$ "x $\frac{1}{8}$ " angle steel frame. Skip is raised with  $\frac{3}{8}$ " crucible steel cable. Spring buffer provided on frame.

*Loader Hoist*—Drum, 6" diameter; overhead drum, 10" diameter. Cable spools, 6" diameter; overhead shaft, 1 $\frac{1}{8}$ " diameter cold rolled polished steel, supported by two babbitted bearings 3" wide, adjustable for wear.

*Clutch*—Cone, hoist type, 11 $\frac{3}{4}$ " diameter, 2" face.

*Brake*—Band type, with non-burning asbestos lining.

*Control*—One-man, one-lever—impossible to use clutch against brake.

*Water-Measuring Tank*—Electrically-welded. 14"x30", 19 gallon capacity tested to 200 lbs. air pressure. Easily adjustable. No internal mechanism. Water feed pipe, 1 $\frac{1}{2}$ " diameter.

*General*—All machines tested under own power and loader must lift 75% overload.

### Weights—Wonder 7 with Loader

Complete with loader gasoline engine steel house and water-measuring tank .....	4400 lbs.
On trucks without water-measuring tank.....	4230 lbs.

FREDERICK ROEBER  
507 FIFTH AVENUE  
NEW YORK

Att: Mr. Wilson

January 10, 1920

F. H. Conklin & W. G. Harrington, Inc.  
50 Church Street,  
New York City.

Gentlemen:-

I am very glad to reply to your enquiry regarding the "Little Wonder Concrete Mixer" which I bought and put to a severe test in the laying of the Floor Concrete at the Eighth Coast Artillery Armory in this City, which, by the way, has the distinction of being the largest Drill Floor in the world.

The Mixer is worthy of its title and this explains why. The Contract for laying the six inch (6") Cinder Concrete Foundation was awarded to me last June, 1919, but owing to delays, the work was not ordered until November 15th and at the same time, I was informed that the National Auto Truck Show expected to have the use of the Floor on and after January 1, 1920.

I actually started laying concrete on November 24, 1919 and expected to put in a second Mixer should the occasion demand it, but found that not only did the "Little Wonder" do what I estimated it could, but I actually doubled up, and several days finished ten thousand and two hundred square feet (10,200') in ten hours, or over One hundred and eighty-five cubic yards. The last Concrete was put in on December 24, 1919 giving us ample time to clean up, etc., for the Exhibition.

The only trouble I had, was in getting enough supplies to feed the Mixer.

If you care at any time to refer to me, I shall be very pleased to tell of my experience.

Yours very truly,

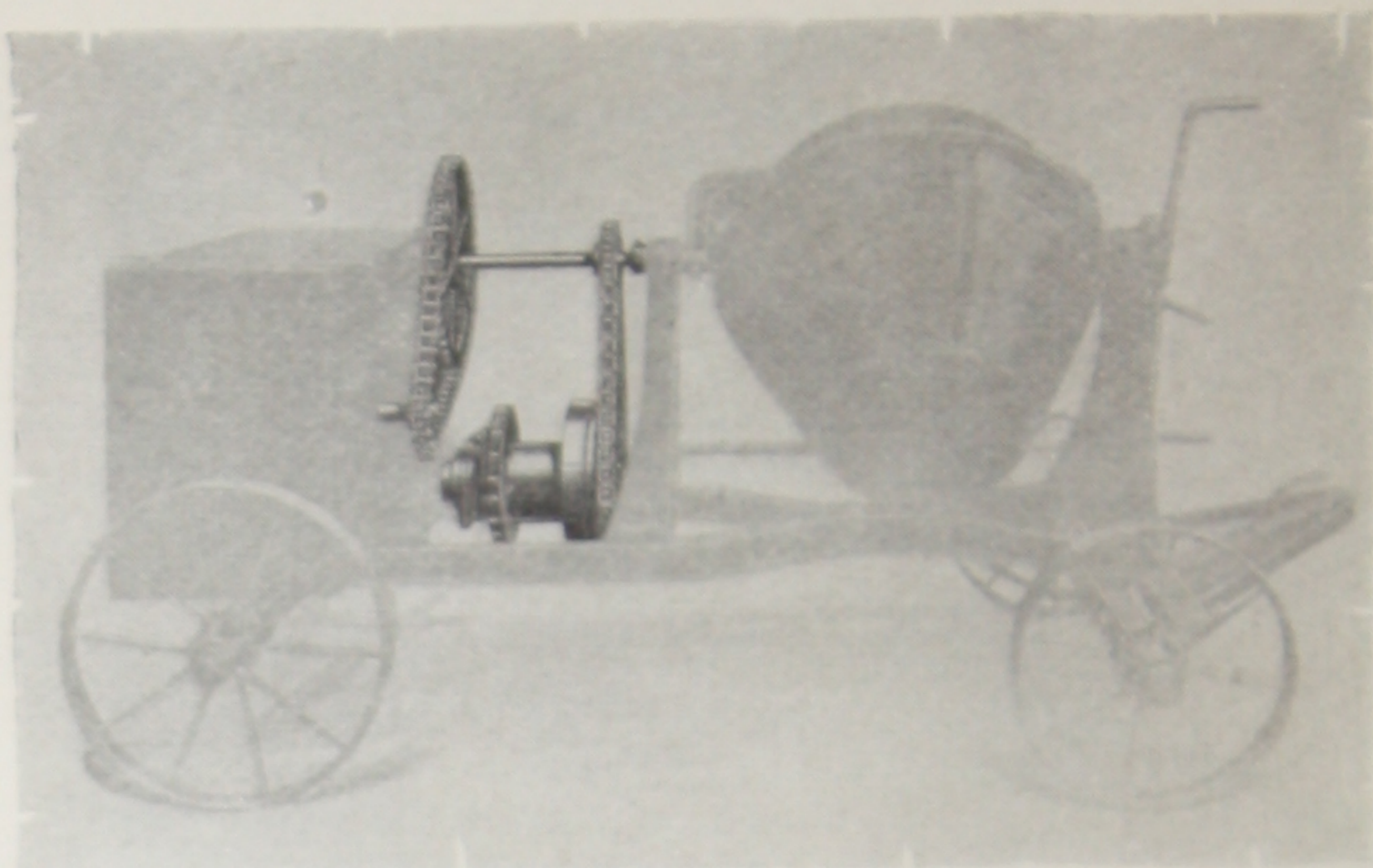
*Frederick Roebel*  
by J. H. Harrington

FR:MM



**10,200**  
square feet of floor  
concrete in 10 hours  
with ONE "Little  
Wonder" Mixer.





## Light Hoisting Equipment

*For Wonder 4, Wonder 5 and Wonder 7—Also Furnished in Combination with Loader, Tank, Etc.*

THIS hoist was designed primarily to meet the needs of contractors in the construction of silos. And it is also a great time- and labor-saver for contractors who must hoist materials of the lighter sort, being used extensively by brick contractors for hoisting brick and mortar as well as other materials.

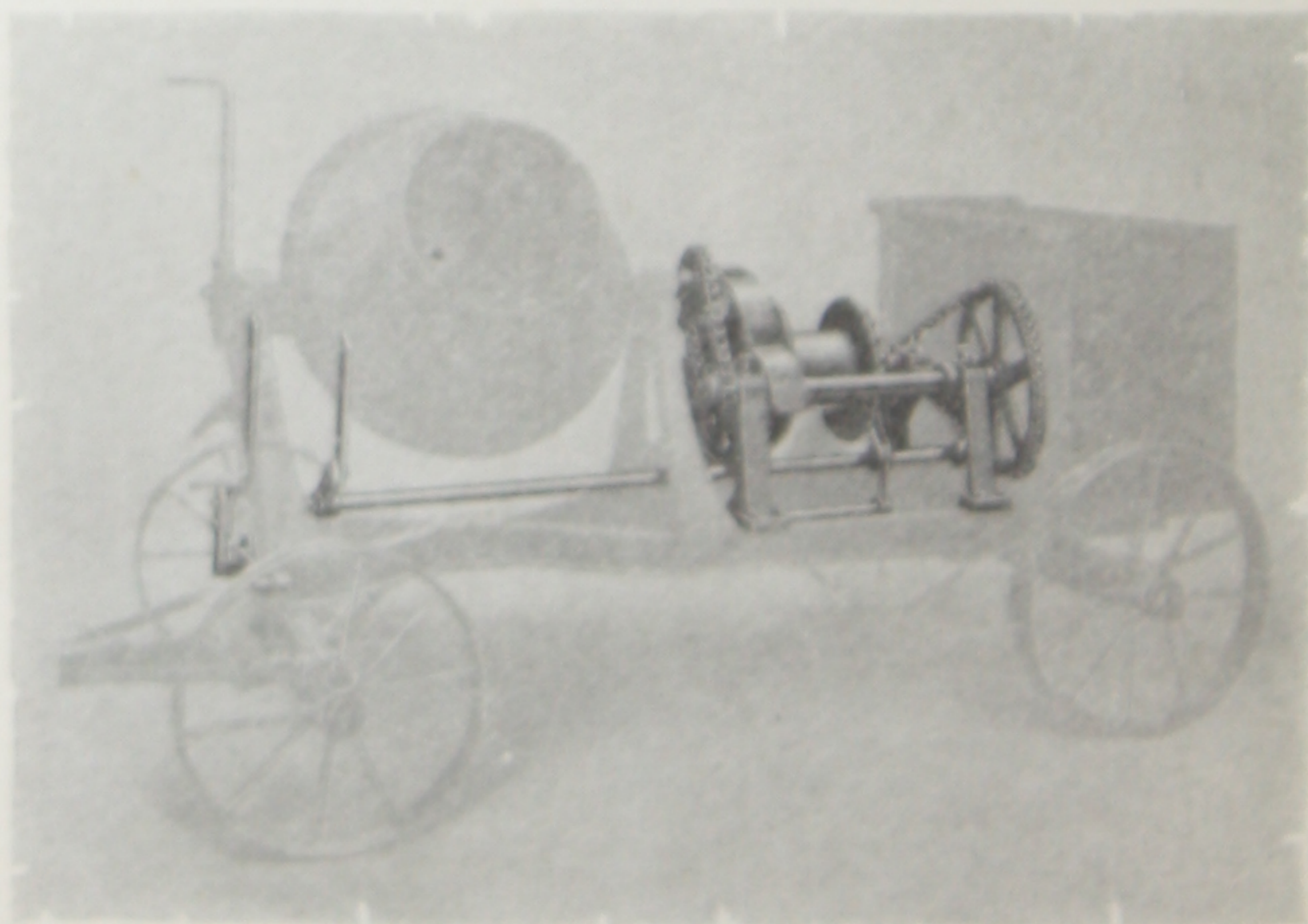
The machine presents a complete outfit on one set of trucks. It is simple, strong and dependable; it is only one foot longer than our standard mixer, and the hoist adds but 200 pounds weight.

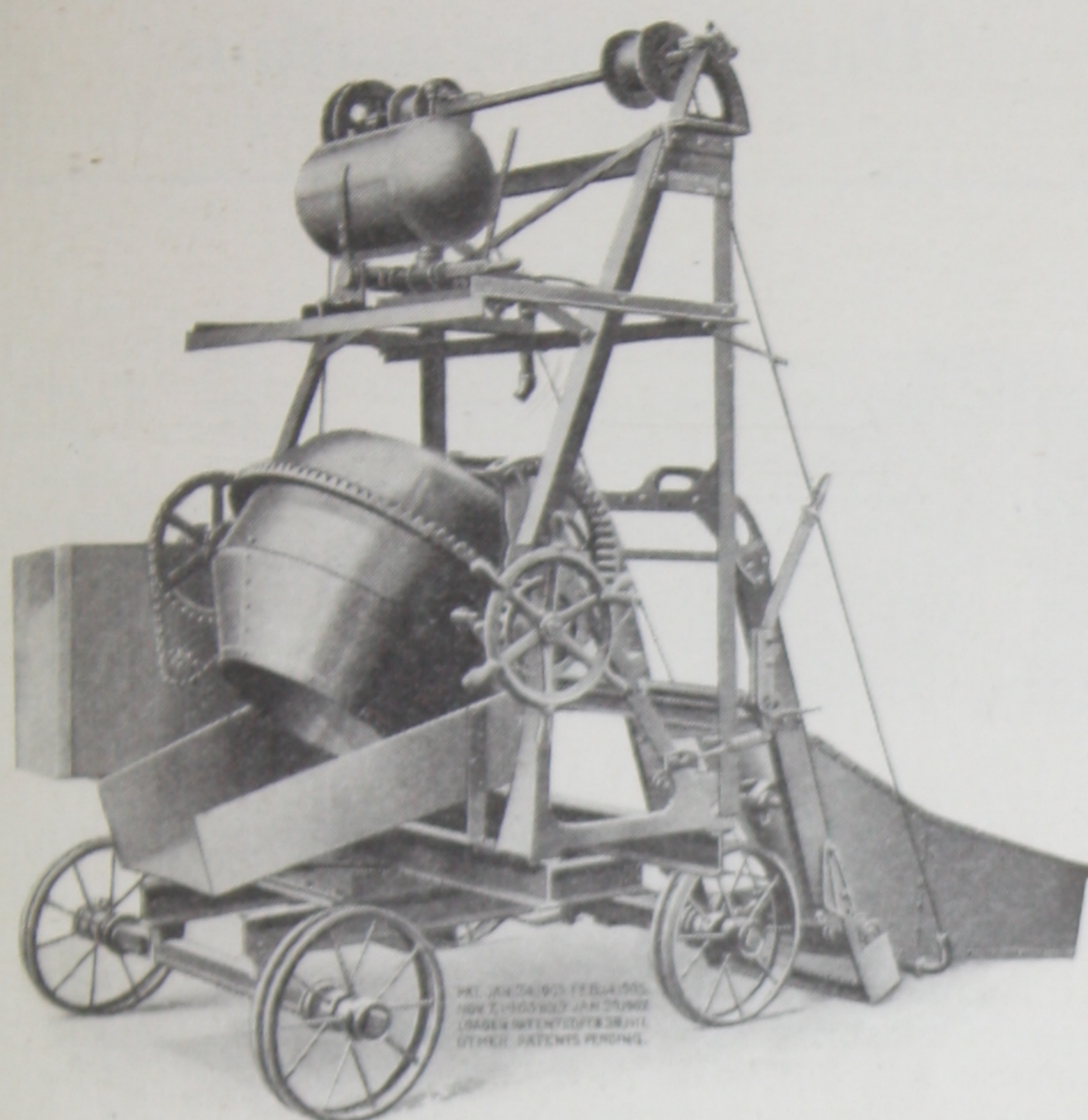
## Heavy Duty Hoisting Equipment

*For Wonder 4, Wonder 5 and Wonder 7—Also Furnished in Combination with Loader, Tank, Etc.*

THIS machine combines the advantages of the WONDER Mixer and a Builders' Hoist on one set of trucks. This makes a light, compact and easily portable outfit. The hoist is designed to handle a large load when necessary and at fairly high speed.

The shafts have extra wide babbitted bearings, and the hoist is equipped with our patent helix thrust and cone friction clutch, also lever-controlled band brake, with non-burning asbestos brake lining. The hoisting drum is provided with a ratchet and pawl for holding the load at rest.





## Quick Convertible Discharge

*This machine can be changed from Side Discharge to End Discharge, or vice versa, in a few minutes.*

THE Quick Convertible Discharge WONDER Mixer is furnished in WONDER 4, WONDER 5 or WONDER 7 with Folding Track Loader. Specifications for each size are the same as those given for side discharge mixers on pages 12 to 18 inclusive, except as follows:

### Specifications

	WONDER 4	WONDER 5	WONDER 7
Over all height .....	10' 2"	10' 2"	10' 1"
Over all width when arranged for end discharge .....	7' 5"	8' 7"	9' 6"
Over all length when arranged for end discharge.			
Loader bucket down .....	10' 3"	10' 3"	11' 6"
Loader bucket up .....	6' 6"	6' 6"	7' 0"
Over all width when arranged for side discharge.			
Loader bucket down .....	10' 3"	10' 3"	11' 6"
Loader bucket up .....	6' 6"	6' 6"	7' 0"
Over all length when arranged for side discharge .....	7' 5"	8' 7"	9' 6"
Height of drum discharge.....	41"	41"	40"
Size of wheels, front and rear.....	23"	23"	26"
Wheel Base .....	4' 9"	4' 9"	4' 9"
Weight, equipped with loader but without tank .....	3340	3925	5030

This model must necessarily be equipped with loader. Other accessories such as tank, pump and distributing spout, can be furnished if desired. Auxiliary hoist *cannot* be furnished in this type.

# Handy Information

## Concrete Silos



1. There are several types of concrete silos — monolithic, block, cement-stave and stucco or plastered.

2. Locate silo next to barn with chute facing it. Firm ground is necessary

to bear great weight of filled silo.

3. Determine number of animals to be fed and length of feeding, allowing for normal increase in number of animals in future.

This table gives the number of cows in herd and tonnage of silage for both one hundred and eighty and two hundred and forty days of feeding of 40 pounds of silage per cow, also acreage of corn estimated to fill the silo and the dimensions of the silo itself. The diameters given are such that at least two inches in depth of silage will be taken off daily.

An acre of land gives about one ton of silage for every five bushels of corn. If any acre yields 80 bushels it will produce about 16 tons of silage. This table is based on a yield of 50 bushels, or 10 tons of silage per acre.

NUMBER OF COWS IN HERD	FEED FOR 180 DAYS				FEED FOR 240 DAYS			
	Estimated Tonnage of Silage Consumed	Size of Silo		Corn Acreage Required at 10 Tons to Acre	Estimated Tonnage of Silage Consumed	Size of Silo		Corn Acreage Required at 10 Tons to Acre
		Diameter	Height			Diameter	Height	
	Tons	Feet	Feet	Acres	Tons	Feet	Feet	Acres
10.....	36	10	25	3½	48	10	31	5
12.....	43	10	28	4½	57	10	35	6
15.....	54	11	29	5½	72	11	36	7½
20.....	72	12	32	7	96	12	39	10
25.....	90	13	33	9	123	14	37	12½
30.....	108	14	34	11	144	15	37	14½
35.....	126	15	34	13	168	16	38	17
40.....	144	16	35	14½	192	17	39	19½
45.....	162	16	37	16½	216	18	39	22
50.....	180	17	37	18	240	19	39	24
60.....	216	18	39	22	288	20	40	29
70.....	252	19	40	25½	336	20	46	34

## Monolithic Silo

1. The University of Wisconsin silo form is recommended if forms are to be made by farmer. (Description in Bulletin No. 21, Portland Cement Association.)

2. Both intermittent and continuous doorways may be used.

### Reinforcing.

Silos must be reinforced both horizontally and vertically. Vertical reinforcement for all diameters ½-inch or ⅝-inch steel rods, spaced 30 inches apart, regardless of the size of the silo. Use twisted square bars if possible. Wire mesh may also be used for reinforcing.

Below is table for amount of horizontal reinforcing:

HORIZONTAL REINFORCING BARS FOR SILOS OF VARIOUS  
INSIDE DIAMETERS. (Use Square Bars)

DISTANCE IN FEET DOWN FROM TOP OF SILO	8 FT. DIAM- ETER	10 FT. DIAM- ETER	12 FT. DIAM- ETER	14 FT. DIAM- ETER	16 FT. DIAM- ETER	18 FT. DIAM- ETER	20 FT. DIAM- ETER
	$\frac{1}{4}$ Inch Bars	$\frac{1}{4}$ Inch Bars	$\frac{1}{4}$ Inch Bars	$\frac{1}{4}$ Inch Bars	$\frac{1}{4}$ Inch Bars	$\frac{1}{4}$ Inch Bars	$\frac{1}{4}$ Inch Bars
Top to 5 ft. ....	Inch 24	Inch 24	Inch 24	Inch 24	Inch 24	Inch 24	Inch 24
5 ft. to 10 ft. ....	15 $\frac{1}{2}$	12	24	24	24	24	24
10 " " 15 " ....	10 $\frac{1}{2}$	8 $\frac{1}{2}$	16	24	20	19	17
15 " " 20 " ....	7 $\frac{1}{2}$	6 $\frac{1}{2}$	12	18	16	14	12
20 " " 25 " ....	6	5	9 $\frac{1}{2}$	14	12 $\frac{1}{2}$	11	10
25 " " 30 " ....	5	4	8	12	10 $\frac{1}{2}$	9 $\frac{1}{2}$	8 $\frac{1}{2}$
30 " " 35 " ....	..	3 $\frac{1}{2}$	7	10 $\frac{1}{2}$	9	8	7 $\frac{1}{2}$
35 " " 40 " ....	..	3	6	9	8	7	6 $\frac{1}{2}$
40 " " 45 " ....	..	..	5	8	7	6	5 $\frac{1}{2}$
45 " " 50 " ....	..	..	4 $\frac{1}{2}$	7	6 $\frac{1}{2}$	5 $\frac{1}{2}$	5

### Mixing.

For foundation and floor use—1:2 $\frac{1}{2}$ :5 mixture of crushed stone or pebbles; for walls use 1:2 $\frac{1}{2}$ :4.

All materials are proportioned by volume; 1 bag cement equals 1 cubic foot.

## Silo Walls

All walls are made 6 inches thick, with reinforcement placed in center. There are seven operations in building silo walls, which are as follows:

1. The reinforcement must be placed ready for the concrete.
2. The forms set in position.
3. The concrete mixed and placed in the forms around the reinforcement.
4. The outside form loosened and raised and reset.
5. The reinforcement placed for the next course.
6. The inside form loosened, hoisted, and reset, ready for the next section of concrete.
7. Openings formed in walls for doors, provision made for roof and chute, and other details.

If rough spots are left when forms are removed from interior of walls, these can be smoothed over by applying a coat of mortar of 1 part cement and 1 part fine sand, mixed with water to consistency of cream. Before applying, brush wall with dry, stiff brush. Wet wall and apply wash.

### Concrete Roof.

The concrete for the roof is laid 4 inches thick on a temporary wooden roof, which will be removed in two or three weeks, when the concrete attains its strength and becomes self-supporting. The concrete should be reinforced with steel rods  $\frac{3}{8}$ -inch in diameter. Some of the rods are laid like the spokes of a wheel, 1 inch from the under side of the roof. At the eaves the rods are 18 inches apart; but every other rod runs only half-way to the peak, where it is tied to a horizontal ring extending entirely around the roof. There are four of these horizontal rings equally spaced from the eaves to the center of the roof. Where the straight or radial rods meet at the peak they should be





hooked and securely tied together. In the eaves an additional ring is placed, around which are hooked the outer ends of the straight rods. Lower the inner form 6 inches to allow for forms of the roof.

## Lime Mortar

There is no economy in using poor mortar; for the reason that when the mortar does not work easily, a mason will not be able to lay as many bricks a day.

It is better that lime should not be made into mortar as soon as slacked, but be allowed to remain slacked for a day or two.

Lime mortar becomes harder and more adhesive to brick or stone if the proportion of lime is increased. Common lime mortar exposed to constant moisture will never harden properly; even when very old and hard it absorbs water freely.

A mixture of one part lime putty to two parts sand makes the most satisfactory mortar.

Bulk of mixed mortar will usually exceed that of the dry loose sand by one-eighth.

One man will slack, mix and temper four cubic yards of bulk lime or cement mortar in eight hours.

A man should mix enough per day for 7 to 9 masons on jobs where only common brick are being used.

With a small WONDER Concrete Mixer one man will mix enough mortar for 25 masons.

### *Factors for One Barrel of Lime.*

- 1 bushel lime weighs 80 lbs.
- 1 bushel lime,  $2\frac{1}{2}$  bushels, weighs 200 lbs.
- 1 barrel lime contains 3 cu. ft.
- 1 barrel lime should produce 8 cu. ft. of lime putty.
- 1 cu. ft. lime should produce 2.62 cu. ft. lime putty.

### *Cost per Cubic Yard of Lime Mortar*

#### Materials—

2 bbls. bulk lime at \$1.35.....	\$2.70
1 cu. yd. sand .....	2.25

Material cost per cu. yd. .... \$4.95

Material cost per cu. ft. .... .18 $\frac{1}{2}$

#### Labor—(80 cents an hour)

Time of one man, 2 hrs. at 80c.

Labor cost per cu. yd. .... 1.60

Labor cost per cu. ft. .... .06

Total cost per cu. yd. .... 6.55

Total cost per cu. ft. .... .24 $\frac{1}{4}$

Cost of Mortar per M brick,

18 cu. ft. mortar at 24 $\frac{1}{4}$ c ..... 4.37

## Cement Mortar

*Sand*—Use clean sharp sand and clean water.

Avoid the use of fine sand; when used the proportion of cement should be increased.

Good sand in a 1 to 3 mixture frequently gives greater strength than a poorer one mixed 1 to 2.

*Water*—Excess of water decreases the density of mortar, and therefore the strength.

A deficiency of water may affect the permanent strength of mortar.

A mixture of fine sand and cement will be less dense and require a larger percentage of water in gaging than a mixture of coarse sand and cement.

*Regaging*—Up to the time of the initial set of the cement, mortar or concrete may be regaged without loss of strength or regaging.

Regaging of mortar that has begun to stiffen should not be permitted.

*Strength*—Mortars containing small amounts of sand are often stronger than neat cement mortar.

*Proportions*—The proportions commonly employed in practice are:

For Portland Cement 1:2 or 1:3.

The difference between two sands may make more than a unit difference in the proportion: for example, a 1:3 mortar with one sand may be better than a 1:2 mortar with another sand.

*Quantity of mortar required to lay 1000 common bricks of average size.*

Joints between bricks—

width inches . . . . .	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1
Cu. ft. of mortar for 1000							
common bricks . . . .	6	9	13	18	18½	21	27

### Quantities of Materials for Plaster Work

For 100 sq. yds. of three-coat lime plaster work on wood lath, use 10 bu. of lime, 42 cu. ft. of sand, 15 lbs. of hair and 100 lbs. of plaster of Paris.

For scratch and brown coat only, omit the plaster of Paris and deduct 2 bu. of lime.

For sand finish on scratch and brown coat, omit the plaster of Paris and add 14 cu. ft. of sand.

For two-coat work on brick, stone or terra cotta walls, deduct 2 bu. of lime and use 100 lbs. of plaster of Paris.

In white coat work use 90 lbs. of lime, 50 lbs. of plaster of Paris and 50 lbs. of marble dust for 100 sq. yds.

In skim work use 1 bbl. of lime, 1 bbl. of plaster of Paris and 1 bbl. of sand for 140 sq. yds.

For two-coat drawn work, use 1,000 lbs. of hard wall plaster and finish and 2 yds. of sand for 100 sq. yds.

For three-coat dry work, use 1,600 lbs. of plaster and finish and 2½ cu. yds. of sand for 100 sq. yds.

For three-coat work on metal lath use 2,200 lbs. plaster and finish and 3 cu. yds. of sand for 100 sq. yds.

### Materials Required for Stucco

One bbl. of cement mixed with 1 bbl. of sand will yield 66 sq. ft. of cement plaster one inch in thickness; 90 sq. ft.  $\frac{3}{4}$ -inch in thickness, 134 sq. ft.  $\frac{1}{2}$ -inch in thickness and 268 sq. ft.  $\frac{1}{4}$ -inch in thickness.

One bbl. of cement mixed with 2 bbls. of sand will yield 104 sq. ft. of cement plaster 1-inch in thickness; 129 sq. ft.  $\frac{3}{4}$ -inch in thickness; 208 sq. ft.  $\frac{1}{2}$ -inch in thickness and 416 sq. ft.  $\frac{1}{4}$ -inch in thickness.

One bbl. of cement mixed with 3 bbls. of sand will yield 140 sq. ft. of cement plaster 1-inch in thickness; 187 sq. ft.  $\frac{3}{4}$ -inch in thickness 280 sq. ft.  $\frac{1}{2}$ -inch in thickness and 560 sq. ft.  $\frac{1}{4}$ -inch in thickness.

### Brick

1000 brick  $8\frac{1}{4} \times 4 \times 2\frac{1}{4}$  with joints  $\frac{3}{8}$  to  $\frac{1}{2}$ -inch make 2 cu. yds. or 54 cu. ft. One-third of the mass, 18 cu. ft., is mortar.



